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PROCEEDINGS OF THE PHILADELPHIA FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club, in Philadelphia, on Wednesday, April 7.

The president, P. D. Wanner, occupied the chair.

Secretary Evans announced the death of Godfrey Rebmann of the firm of G. Rebmann & Co., Philadelphia, iron founders, and Henry Ruhland, of Philadelphia, at one time actively connected with the Girard Iron Foundry, both members of the association.

The secretary stated that it had become customary at the first meeting of each quarter to receive reports from members regarding the state of the foundry trade in their different sections. Such reports would be in order that evening.

THE CONDITION OF BUSINESS.

John Rohland, of the Cross Creek Colliery, Drifton, Pa., said: "Business has improved a little, but not a great deal. I understand that the Jeanesville Iron Works are fairly well filled up with orders, and that the Jackson & Woodin Company, at

Berwick, have all they can do for the present. Other foundries around us are not quite so well off."

Mr. Betts, of the Betts Machine Company, Wilmington, Del., said: "Our foundry work is mostly for our own machine shop. We do not do much outside work. Just at present, however, we have a little more than we have had, but I cannot see that prices are any better; if anything they are a little worse."

Mr. Newbold, of H. D. Newbold & Son, Norristown, Pa., said: "We are so near Philadelphia that we are in about the same conditions as the Philadelphia foundries. We are doing a good deal more than we were doing in August or September, but it is a hand to mouth sort of business, coming in a little at a time. We do not see anything ahead and prices are terribly low. We hear of work being taken at prices we cannot begin to touch."

Mr. Moore, of S. L. Moore & Sons Company, Elizabethport, N. J.: "I may state that our foundry business is not as good as it has been all winter. We were fairly busy through the winter, but at the usual low prices of which everybody complains. We are not running as many men as a month ago. Our machine shop business is holding up pretty well. We do a general jobbing business and do not use in our machine shop more than 5 per cent of the iron we melt. Our trade is principally with oil refineries and chemical works, with a little in the shipbuilding line. The outlook is not at all encouraging."

Mr. Ellicott, of the Southwark Foundry & Machine Company, Philadelphia, Pa.: "As far as our foundry is concerned, two months ago we were doing very little, only running five days a week, with a very limited force of men. We formerly had about 230 men in the foundry, and this force was reduced to 65 all told. Within the last two months business has been improving, and now we are pretty busy. We are building several large engines, two 36x48 and two 28x42 Porter-Allen engines, a vertical cross compound engine and others. Within a day or two there has been booked an order for two vertical compound engines of good size for Russia, which are required to be shipped in a short space of time. We shall be busy for two months to come."

Mr. Pole, of Bement, Miles & Co., Philadelphia: "I cannot say much. Business has improved a little, but prices are very low."

Mr. Nagle, of the A. & P. Roberts Company, Pencoyd, Pa.: "As far as our foundry is concerned it is a very small part of our business. We have been very busy all through the dull times, making castings in connection with structural material, and that is about the only class of work we have for a foundry, excepting such as we require for our own use. We have quite a lot of work in the foundry now for buildings in New York, and also for some in the city."

H. E. Asbury, of the Enterprise Manufacturing Company, Philadelphia: "Nine-tenths of our castings are made for our own use entirely, so that our foundry business would be a very bad barometer to go by when feeling the pulse of the foundry trade. We have felt the business depression with the rest, but the outlook is a little better now. Our export trade has picked up, and we have tried to open new export fields."

J. Glover, of Glover Bros., Frankford, Philadelphia: "We have only a little place, but our little place is so full of work that we have not a spare inch of room; but the work is low priced. We have to come down to other people's prices, but we are still in business and intend to remain as long as there is anything in the market. We lost a job the other day. We have been making boiler heads at 1½ cents per pound, but some one from the country has now taken them at 1¼ cents. We had the privilege of taking the work at the latter figures, but of course declined."

Mr. Braun, of J. Braun & Sons, Philadelphia: "Our work is almost entirely for our own use. In our lawn mower department we have been quite busy ever since October. Of course we cannot tell what the future will bring, but outside of our own work we have been running along about the same as usual, and we cannot see anything in the way of improvement."

J. S. Stirling, Harlan & Hollingsworth Company, Wilmington, Del.: "As far as our foundry is concerned we are almost in statu quo. We have no more to do than we had two or three

months ago. I think the outlook is a little better. We have taken some nice orders lately in our shipbuilding department."

F. Schumann, Tacony Iron & Metal Company, Tacony, Philadelphia, said: "We are reasonably satisfied with what we are doing. Prices with us are undoubtedly improving. The volume of business is small, but we have established a policy that we will not enter the prevalent unlimited competition, and will confine ourselves to such work as is difficult to do, and is subject to what may be termed the cranky inspection of individuals, which we prepare for in our estimates. We find that this class of work leaves a margin. It is quite true that our business has diminished from a volume which enabled us to employ 450 men to a volume which necessitates the employment of only 250 men, but we find it is more profitable to limit ourselves to such business as we can make a profit on than to take work for 450 men and lose money on it. We are also gradually adjusting ourselves to diminished hours of labor, as I feel satisfied that the prosperity which many have hoped for as equaling that of a decade ago will not arrive. The country has ceased to grow in the proportion it did in 1870 to 1880. The growth in population was then, I think, about 30 per cent on the population previously recorded, while the years 1880 to 1890 only showed an increase of about 24 per cent. Pioneering in the great West has also, I am informed, retrogressed about 300 miles. That indicates that the expansion of our industries has been in accordance with the demands growing out of the destructive course of the war and the rapid growth of the population in the years 1882 and 1883. We are in that condition now that the producing capacity of the country is undoubtedly too large, and will be for quite a period. I have, therefore, the idea that we should adjust ourselves accordingly, reduce administration expenses and put up with a diminished business. We are reasonably satisfied with what we are doing, and prices are certainly better than they were three months ago."

Mr. Green, of the Vulcan Iron Works, Chester, Pa., said: "Business with us is rather limited, and prices are very low. The only foundries busy in Chester are those making steel castings,

and I am told they are making prices particularly low. The iron foundry business in Chester is in a deplorable state yet."

P. D. Wanner, of the Reading Foundry Company, Reading, Pa., said: "Prosperity for water pipe makers can hardly be looked for at the end of a period of depression. Cities, like individuals, are reduced to such an extent that they are not in a position to appropriate the sums of money required to make improvements, and for that reason pipe founders will not be benefited by a return to prosperity in the same proportion as will other industries. The cast iron pipe trades must look for better business later in the era of prosperity than other industries, because cities and towns have to accumulate funds before they can go into new enterprises requiring cast iron pipe, or supplies in our line." Mr. Wanner then spoke of the fulfilment of many predictions made by him within the past five or six years, all pointing to the present poor condition of the pipe trade. Continuing, he said: "Only yesterday there was a letting in Brooklyn for about 1,300 tons of pipe and 200 tons of specials, and to my surprise the Addystone Company, of Cincinnati, were the lowest bidders, their bid being $18.48 for the pipe and 1.87½ cents for the castings. I do not know whether they will be awarded the contract or not, but in any event anything like that unsteadies the business, and it may take two or three weeks before prices can rise. I believe we are on the eve of a revival in business, but what it will bring forth I do not know. I think with Mr. Schumann it is well for us not to be too sanguine, because there are conditions to-day which are entirely different from what they were after the panic of the seventies. While I have no doubt as to an early revival of business, the volume attained will not be so great or the profits so handsome as they were after the panic just mentioned. I wish it might be so. With a settlement of the tariff question we must have a change in the times."

Mr. Joseph Allison Steinmetz, of Philadelphia, read the following paper on

"ALUMINUM AND ITS USE IN THE FOUNDRY."

A Few General Remarks Covering the Uses of Aluminum or Alloys Thereof, in Ordinary Cast Iron Foundry Practice.

It is the purpose of this paper to treat of this development only in a brief and general manner, in order that the subject may be brought to the attention of foundry interests, and in the hopes that the introduction will lead to further experiments with and uses of aluminium metal along the lines to be hereafter sketched.

In all matters pertaining to aluminium, outside of the very narrow field of personal experience, it is necessary that reference be made from time to time to those sources of information and data which are, beyond any doubt, of absolute authenticity.

Therefore, it is with pleasure that I refer all persons who are in any way interested in this metal aluminium to the first and only comprehensive work published upon this subject, entitled "Aluminium; Its History, Occurrence, Properties, Metallurgy, and Applications, Including Its Alloys," by Joseph W. Richards, A. C., Ph. D., and professor of metallurgy at the Lehigh University. And from this excellent compilation will be made sundry quotations of those parts that are pertinent to the matter in hand.

I will not touch upon the subject of aluminium in steel castings, for the reason that the scope of this paper embraces only the cast-iron foundry practice, although it is well to state that for several years the bulk of the steel castings companies have been very large users of aluminium in their work. In fact, several of the largest concerns used steadily as much as from one to two tons of pure aluminium metal per month. In all cases it is earnestly recommended to purchase pure aluminium, whether for steel or iron castings, for the reason that you can make your own ferro-aluminium alloys of absolute and unvariable proportions, and also, as a point of economy, to pay freight on the light-weight pure aluminium, instead of the heavy alloy. We would, however, always recommend that the ferro-aluminium alloy be mixed with the molten metal, as in this form the aluminium suffers less waste

than the pure metal and assimilates more easily and more thoroughly with the pour.

The high price of aluminium has heretofore been the great barrier to its general use in cast iron foundry work, but this is no longer the case, as there can now be furnished the purest 98 to 99 per cent metal at a price that puts it within the economical use of all foundrymen, considering the advantages to be derived from its use.

As early as 1858, when the metal was almost a laboratory curiosity, the possibility of this application was suggested, as soon as its price would warrant, and that time is now.

Almost 30 years later, or in 1885, the discovery and publication of the Mitis Process caused a very general interest among experimenters and certain foundries to determine the effects produced by aluminium on cast iron.

The general advantages claimed by the exploiters of these processes, of the additions of pure aluminium and ferro-aluminium into cast iron, were very broad and attractive and may be correctly listed, for our consideration, under the following headings:

First. Makes the iron more fluid.

Second. Makes hard iron softer.

Third. Castings thus made are freed from hard spots and blow-holes.

Fourth. Lessens the tendency of the metal to chill.

Fifth. Increases the resistance of the metal to chemical action.

It is also stated that while good, soft iron is made more fluid and benefited to some degree, yet the advantages of treating with aluminium are most evident with poor, hard, white iron.

In relation to the above claims we will review them in detail and in the light of trustworthy experiments, which have been made, under the above headings, and which are properly certified to.

It is now an unquestionable fact that the addition of aluminium very considerably affects the quality of the castings for the

better. The method of adding it which has been generally adopted is to put some pieces of broken ferro-aluminium into the bottom of the ladle, preferably a hot one, and tap the iron from the cupola directly on the alloy.

A German experimenter states that it is important that the iron be not too hot when the ferro-aluminium is added, for if it is white-hot the aluminium burns with a greenish flame and a peculiar smell; a golden-yellow heat is recommended as the right heat for treatment. If the ferro-aluminium is thrown into the molten iron at this heat the streaks playing on the surface of the metal disappear, and the bath becomes blistery looking. While there have been many testimonials from practical men as to the benefits derived from the use of ferro-aluminium, testimonials so numerous that the fact of benefit has become indisputable, the only systematic investigation of the subject that is cited in Dr. Richard's work on aluminium, the text of which I have had the honor of quoting so frequently in the paper, is the series of comparative tests made by Mr. W. J. Keep, of the Michigan Stove Company, of Detroit, with the co-operation of Professor C. F. Maybury and L. D. Voree. Their results are embodied in two quite lengthy papers, one read before the American Association for the Advancement of Science at their Cleveland meeting, August 17, 1888; the other published in the transactions of the American Institute of Mining Engineers, December, 1889.

I refer to the papers as original investigations and to Dr. Richard's book, wherein said experiments are largely quoted, and as I shall take the bulk of my matter from these sources, it will be well to first explain the methods employed in pursuing these investigations.

Two kinds of iron were used, having the following composition:

	White Iron	and	Gray Iron.
Silicon	0.186	——	1.219
Phosphorus	0.263	——	0.084
Sulphur	0.031	——	0.040
Manganese	0.092	——	0.187
Graphite carbon	0.95	——	3.22
Combined carbon	2.03	——	0.33
Total	2.980	——	3.550

The ferro-aluminium used contained 11.42 per cent of aluminium and 3.86 per cent of silicon.

The melting was done in a covered plumbago crucible, and the melt was run into test-bars, one foot long, some having a section one-half inch square; others one inch wide and one-tenth inch thick. The ferro-aluminium was added to the molten iron, the smallest quantity first, and, after casting, part of this first cast was remelted with more ferro-aluminium, and so on.

Another series of heats was made under exactly the same conditions, but without adding aluminium, these tests serving for comparison and determination of the true effect of adding the ferro-aluminium.

The general scheme of the tests consisted in adding 0.25, 0.50, 0.75 and 1.00 per cent of aluminium to the white iron, and 0.25, 0.50, 0.75, 1, 2, 3 and 4 per cent to the gray iron, the test bars being carefully examined as to strength, shrinkage, etc., and comparison made with the corresponding remelt of the iron alone. The weak point of the first set of tests, recorded in the first paper, was the fact that many of the changes credited to the addition of the ferro-aluminium might probably have been accounted for by the silicon in the alloy added, and so the results could not be accepted as demonstrating the influence of the aluminium except where the change was in a direction contrary to that which the silicon could have produced.

Mr. Keep recognized at once the necessity of differentiating the effect of these two elements, which was accomplished very ingeniously by finding an iron containing the same amounts of silicon, carbon, etc., as the ferro-aluminium, and making comparison tests with this iron in place of the aluminium alloy; also by adding pure metallic aluminium to the iron. Since Mr. Keep's method of presenting his results is in some cases not easily understood, Dr. Richards, from an inspection of his diagrams, recast these results into tabular shape, and reference and tribute is again made to the doctor's great work on "Aluminium."

Solidity of Castings.—All of Mr. Keep's tests bore on this point, but one particular test was made with white iron, adding

only 0.1 per cent of aluminium (0.03 of silicon). The castings were of slightly finer grain, but blow-holes and intestitial cavities were noticeably absent, this accounting for the largely increased strength. The resistance to dead weight was increased 44 per cent, and to impact 6 per cent. No check test was made to eliminate the effect of the silicon added, but the effect of the silicon much greater than can with any probability be ascribed to the silicon alone.

Transverse Strength.—The addition of aluminium in the form of ferro-aluminium has the general effect of strengthening the iron, the white iron showing the greater improvement, and the resistance to impact being increased more than the resistance to dead weight.

The following table gives the percentage increase in strength in each case, the minus quantities in parenthesis meaning decreased strength:

Percentages of Aluminum.	White Iron. Dead Weight.	White Iron. Impact.	Gray Iron. Dead Weight.	Gray Iron. Impact.
0.25	32.5	82.8	—(12.5)	—(15.5)
0.50	128.0	291.0	— (8.9)	44.0
0.75	113.6	240.0	5.8	23.0
1.00	117.6	350.0	2.4	30.0
2.00			—(10.4)	29.0
3.00			4.6	11.0
4.00			15.8	13.0

Since, for every 1 per cent. of aluminum added, 0.34 of silicon was contained in the ferro-aluminum, the question very naturally occurred, how much of this benefit was due to silicon. Tests were therefore made on this point, proving the part taken by the aluminum. The figures show the percentage increase in strength, as in the former tables:

Additions.	White Iron. Dead Weight. Per Cent.	White Iron. Impact. Per Cent.
1 per cent. aluminum as ferro-aluminum	117.6	350.0
Cast iron, introducing the same quantity of silicon	126.8	94.6
1 per cent. of aluminum, as pure aluminum	141.7	156.5

The conclusions to be drawn are, therefore, that while the silicon in the ferro-aluminum is sufficient to explain the increased resistance to a dead weight, yet the increase in resistance to impact is clearly due in large part to the aluminum.

Elasticity.—The closing of the grain of the iron on treatment with ferro-aluminum caused the iron to be less brittle, or more elastic.

The definition of the different specimens for a fixed weight was measured, and the increase in deflection was found to be (in percentages)—

Percentages Aluminum.	White Iron.	Gray Iron.
0.25	31	125
0.50	89	116
0.75	100	147
1.00	153	133
2.00	—	133
3.00	—	194
4.00	—	193

To distinguish the effect due to the silicon added, tests made with silicon and aluminium alone showed increased deflections, as follows:

Addition.	White Iron.
1 per cent. aluminum in ferro-aluminum	153
Cast iron containing equal quantity silicon	11
1 per cent. aluminum as pure aluminum	100

It is thus proved that the increased elasticity is due to the aluminum, caused, as Mr. Keep believes, by a very uniform distribution of the graphitic carbon when aluminum is the element precipitating it.

FLUIDITY OF THE IRON.

The general conclusion from tests made is that with white iron small additions of aluminum, such as would be used in ordinary foundry practice, increases slightly the fluidity; one-half per cent. of aluminum and over decreases the fluidity.

Gray iron is rendered decidedly less fluid by any addition of aluminum.

Shrinkage.—The shrinkages of the various test pieces were

carefully noted, with the general conclusion that the aluminum reduces the shrinkage if enough is added. This development, though of interest, will not warrant a lengthy discussion, as the idea is to bear more upon the physical characteristics of the iron treated, as noted under headings of Elasticity, Soundness and Strength.

Aside from the determinations of Mr. Keep and the other cases cited in Dr. Richards' book, many testimonials could be quoted from practical iron founders if space would allow, as to the practical benefit to poor iron gained by adding ferro-aluminum.

Perhaps one of the most striking results is the increased time which the aluminum-treated iron will remain molten. For instance, Mr. Keep found that 0.02 per cent. of aluminum added to a ladle of iron caused it to keep fluid five minutes, while a similar ladleful of the same metal without aluminum became solid in half that time.

This property of keeping fluid longer is of direct usefulness in a foundry where it is necessary to run a large number of small castings, during which operation there is usually much trouble in keeping the ordinary melt fluid, unless it was very hot to start with. The advantages therefore are evident.

Dr. Richards cites the experience of a friend who described an experiment in which a large ladleful of iron was tapped from a cupola and taken for pouring about 200 yards, partly through the open air. The iron was not hot enough to fill the moulds satisfactorily. Another ladleful, similar in all respects, was tapped immediately afterwards, some ferro-aluminum being placed in the ladle. This iron was taken to the same place for casting, filled the moulds perfectly, and when brought back to the cupola the metal in the ladle was still fluid enough to make good castings.

The general results prove that the molten bath of iron will stay fluid twice as long when treated to aluminum as when run out as ordinary. The other considerations are that cleaner, more solid and softer castings are universally obtained, and at that with a large reduction in the percentage of defective castings. Therefore, after a judicious summing up, we would state boldly that

very small percentages of ferro-aluminium added to unsatisfactory and poor iron will result advantageously.

The field is open to investigations and further work along these lines, and we shall always be glad to give anyone desirous of looking into this matter, our best attention and advice.

At the conclusion of the reading a vote of thanks was taken and tendered to the reader.

Mr. Glover—Where can Prof. Richard's book be purchased?

Mr. Steinmetz—I have no prospectus concerning it here.

Mr. Evans—I may state that I have made some inquiry among foundries as to the results obtained by the use of aluminum, either in the pure state or in 87 or 90 per cent. pure state, or in the ferro, and while every foundryman in this section of the country seems to be impressed with the use of aluminum, as tending to close up the pores and make a more solid and homogeneous casting without adding much strength, I find they did not continue to use it. I should like to know why it is that foundrymen as a rule do not use it.

Mr. Steinmetz—I think the barrier heretofore has been the cost of the metal, which used to run from 50 cents per pound upwards. The metal can now be bought in the neighborhood of 30 to 35 cents and is therefore becoming more attractive. It was at one time $2.50 to $3.00 and even $5.00 per pound. The bulk of what is supplied for foundry use has gone to the steel casting people. Cast iron foundries are using it in a small way, but I do not believe they use 10 per cent. of what the steel foundries use. Perhaps steel castings are harder to make and have different physical properties to overcome. There is surely someone here who has used it, and it would be well to hear what they have to say, as the information would come direct. It has wrongly been considered as the panacea for all ills, consequently a distorted idea as to its use has gone abroad.

Mr. Moore—A few years ago we commenced to use it. We were at that time making ice machines and fittings that would hold ammonia gas. We bought some material and used quite a lot of it, and met with a great deal of success in making close,

strong castings that would stand the test of heavy pressure of ammonia gas. We were satisfied with what we were getting, but soon afterwards a man came along and wanted to sell us some aluminum. We were, as we supposed, getting ferro-aluminum from another party, and I told him we were well satisfied. He asked to see some of it, and being shown it at once, said: "That is not aluminum at all, someone has been sticking you." I said I could not help that, it suited us all right. Finally we were unable to procure any more from the man who had sold to us, and we also shortly afterwards went out of the ice machine business. Whether we were using aluminum or not I do not know.

Mr. Steinmetz—There were on the market, as recently as five years ago, a considerable number of miscellaneous mixtures, marketed under the heading of ferro-aluminum. I have a great suspicion that they did not contain a particle of aluminum. It was natural that the metal should not be known, and perhaps the man who sold it to Mr. Moore did not himself know it. When using aluminum it would be best for the individual to purchase the metal and make his own proportions. The old plan was to put in this so-called ferro-aluminum, and not knowing what it really was, absolute failure generally resulted. There is no reason why aluminum should not be more widely used, and it is worth while to investigate it.

PROCEEDINGS OF THE WESTERN FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Western Foundrymen's Association was held at the Great Northern Hotel, Chicago, April 21, at 8 p. m. In the absence of the president, the vice-president, Wm. Ferguson, took the chair.

The only business before the meeting was the discussion of the proposed amendments to the by-laws and the nomination of officers.

The secretary read the proposed amendments and the original sections and they were thoroughly discussed, and the following were adopted by a two-thirds majority vote:

That Article 2, Section 1, be amended to read as follows: "The membership of this association shall consist of two classes, to be called respectively active and honorary members."

That Sections 2 and 3 of Article 2 be called Section 2, and to read as follows: "Sec. 2. Any person, firm or corporation engaged in the production of castings of any kind, as employed, superintendent, foreman, chemist, or any person whose knowledge or services are valuable towards the objects of this association may be elected an active member."

Section 4 of Article 2, to be amended and called Section 3.

Section 5, Article 2, to be stricken out.

Section 6, Article 2, to be amended and called Section 4, and to be made to read as follows: "Sec. 4. All nominations for membership shall be made in writing to the board of directors, who may, in their discretion, submit the nominee's name at the next regular meeting of the association, when a majority vote in favor of the same shall entitle the nominee to membership upon compliance with the provisions of these by-laws within three months after the date of his election."

Section 7, Article 2, to be amended and called Section 5 and made to read as follows: "Sec. 5. Each member who has duly qualified shall receive an appropriate certificate stating the date

of his election, the certificate to be signed by the president and attested by the secretary."

Section 8, Article 2, to be amended and called Section 6, and made to read as follows: "Sec. 6. Active members shall have the right to vote at the meetings of the association; and any member shall be eligible to election to any of the offices herein provided for except as president, who must be actively engaged or financially interested in the foundry business."

Section 9, Article 2, to be amended and called Section 7.

Article 3, Section 1, to be amended to real as follows: "Sec. 1. Each person, firm or corporation who has been elected to active membership in this association shall pay to the treasurer the sum of $5 as an initiation fee before a certificate of membership shall be issued to him or it."

Section 2, Article 3, to be amended to read as follows: "The annual dues for each active membership of the association shall be $10, payable quarterly in advance."

Section 3, of Article 3, to be stricken out.

Section 4, of Article 3, to be amended and called Section 3.

Section 3, Article 5, to be stricken out.

"Sec. 6, Article 5. At any election, ballots cast by absent members shall be enclosed in special envelopes, sealed and addressed to the tellers of the election in care of the secretary. These special envelopes shall be provided by the association. In case there shall be no election on the first ballot, then a majority vote of the members present shall constitute an election."

Section 1, Article 8. That the order of business be amended to read as follows: Reading of the minutes of the last meeting; report of standing committees and officers; report of special committees; nomination of officers; election of officers; election of new members; unfinished business; new business; good of the association; adjournment.

The other amendments proposed were rejected.

The board of directors was authorized to properly number the articles and sections.

On motion, the secretary was ordered to prepare a list of the present members and to mail it with the report of this meeting.

On motion, the editing committee was authorized to publish the amended by-laws in pamphlet form in such quantities as the committee may deem best.

Nominations for officers for the ensuing year were then handed in and announced as follows:

President—C. A. Sercomb, Wm. Ferguson, W. N. Moore.

Vice-president—Wm. Ferguson, R. Cleveland, C. A. Sercomb, E. W. Smith.

Secretary—B. M. Gardner, A. Sorge, Jr., S. T. Johnston, H. S Vrooman.

Treasurer—O. T. Stantial, S. T. Johnston, G. H. Carver.

Directors—G. H. Carver, J. M. Sweeney, A. W. McArthur, W. N. Moore, H. L. Hotchkiss, Geo. M. Sargent, S. T. Johnston, F. M. Lyon, A. M. Thompson, C. A. Sercomb, R. Cleveland, W. A. Jones.

Editing Committee—B. M. Gardner, Henry W. Carter, E. E. Hanna, H. F. Frohman, Wm. Ferguson, R. Barr, A. Sorge, Jr.

PROCEEDINGS OF THE PITTSBURG FOUNDRYMEN'S ASSOCIATION.

The April meeting of the Pittsburg Foundrymen's Association was held Monday evening, April 26, at the association rooms in the Builders' Exchange, the president, Robert Taylor, in the chair.

The regular order of the meeting was a paper by Richard G. G. Moldenke, Ph. D., of the McConway-Torley Co., on

"RECENT PROGRESS IN THE GRAY IRON FOUNDRY."

It is strange, but nevertheless true, that recent real progress in the foundry is closely identified with the extended period of business depression we are now going through. More money is being spent for improvements, plants are being remodeled to suit the requirements now more severe than ever, and a change is being manifested all along the line, which shows that the "happy-go-lucky" methods of former times are giving way to improved modes of procedure, coincident with the struggle for the survival of the fittest.

We see the old run-ways for taking up the metal and fuel gradually replaced by power elevators, thus doing away with the old foundry maxim—to buy no material which one man alone cannot take up to the charging platform. Greater care is exercised in the selection of the cupola, blowing apparatus, etc., and most notable of all, special attention is paid to the starting point of the industry—the material to be melted.

The natural question arises, what is bringing about this change? The answer is plain. Competition, close, searching, desperate competition in taking the little work to be had, and which has brought down the price on some classes of work which I had formerly cast for myself, from 5 cents to 1¾ cents, and in some cases the drop is even greater.

PROGRESS BY SCIENTIFIC METHODS.

Again, if we look for the means by which such radical changes in the organic life of the foundry business could be brought

about, we see two phases of the same tendency, namely, economy and improvement. This brings us to the foundation of the whole business superstructure, which in its broadest interpretation is simply science—the systematic, logical dealing with the conservation of nature's wealth.

Possibly the average manager in ordering an electric traveling crane for his foundry, to run with his modern electric lighting plant, does not realize that this is what science is doing for him, yet how great is the improvement over the half a dozen stationary jib cranes with their limited reach, and run by man power, which are thus replaced. If he looks over the question of blowers, with a view of selecting the one which gives him the greatest range of pressures according to his needs, together with the least friction in the machine and consequent wear and tear; in other words, if he receives the maximum horse power return, he may have saved only a little at the end of a year, yet remember "many a mickle makes a muckle," as our Scotch friends say. This discriminating process applied to the smallest item in the daily work, eventually places many a cool thousand on the right side of the ledger, and one finally comes to the conclusion that the best is often the cheapest. Now this is science, knowledge, common sense. These three words are synonymous in the foundry.

The careful study of the various aspects of a problem connected with the foundry, involving the notice of every possible requirement, present and future, as far as can be seen, the narrowing down of the matter to definite lines, careful selection of the course to be pursued, proper installation of the apparatus which may have to be purchased, surrounding the operation itself with all the safeguards which are of practical value, and then following the matter up by competent talent, to see that the original efficiency is maintained, and new improvements suggesting themselves adopted—this course of reasoning and action may be summed up into one sentence: "Science gives the best practice" —an axiom the truth of which is becoming more widely recognized daily.

While we are at the subject of science in the foundry,and have

in mind many costly mistakes in this direction, it would be well to look more closely at this matter with a view of aiding those who are about to take up this important subject in conjunction with their established work.

An old German professor once expressed himself as highly displeased at the fact that science was dragged from the universities into practical life. The hard-handed and hard-headed practical man formerly scoffed at the "scientific fellow." Both men, in the light of the new foundry practice, are far behind the times, yet both men can hardly be blamed. We have, for instance, the learned savant, as a rule shortsighted and seldom practical, who chases scientific rainbows and passes veritable gold mines in following some particular hobby. Then the young graduate, who has his years of experience yet to acquire, and to learn to adapt scientific research to the needs of the hour; these classes of men, the rule rather than the exception in their domain, make the ironmaster hesitate about seeking their services. On the other hand, we have the man who does not believe in book learning, who relies on the few formulae he has picked up and learned to apply—the so-called "hand-book engineer," who never lets a problem pass him without making a break at it, at other people's expense. This is the man who uses a big factor of safety to cover up the deficiencies he is conscious of, and who usually spoils the excellent workman he has been and makes an indifferent chief. The industrial world is therefore coming to learn, and the foundry, in particular, must learn, that while for the inferior positions about the laboratories and mechanical departments the self-trained young man with his praiseworthy ambition of graduating into the shop and eventually acquiring a foremanship, is the best to employ, yet for assistants the technical graduate, if at all suitable, may be trained to become a valuable money-maker for his employers. Where, however, the study and perfection of special lines of work is desired, it will pay to utilize the highest grade of talent as the quickest and cheapest means of arriving at paying results. This of course, is expensive, but I know of one instance where a firm quietly bought up the scrap piles of its neighbors and turned them into hard cash by learning to know how.

Possibly the secret of successful work in any line is to make up your mind that you do not know it all and can learn very much more. Only such a man is willing to make an attempt to distinguish the wheat from the chaff.

CHEMISTRY MUST BE SUPPLEMENTED.

Those of you who are acquainted with the wonderful achievements of chemical research, such as determining the compositions of stars we cannot see with the naked eye, must wonder at the somewhat confusing state of the literature we have been getting on the chemistry of foundry work. This has led some eminent workers to lose faith in the chemistry of iron, and turn entirely to the physical aspects of the case. They do not realize that it is not pure chemistry which we need, but metallurgy.

This branch of the applied sciences requires chemistry as the basis of its methods, but draws on mechanics, mining and engineering in general—branches which the everyday chemist is usually ignorant of—to aid in rounding out a system of handling the iron in all its stages in the foundry and machine shop, as it makes its rounds.

If, therefore, chemical work is supplemented by the proper testing methods, trial heats, or other suitable physical determinations of quality, the best results will be obtained, and light will come to those already confused by one-sided or contradictory statements. Remember that no time need be wasted in making any experiments whatever on irons whose chemical composition makes them inherently unfit for your use in the first place.

In looking over the ground indicated by our subject, we see how decided the waking up in the foundry has been. Goods are no longer bought on faith, but are put to the severest tests before anything is said about payment. In fact, certain requirements are laid down flatly before the matter of investigating is thought of. This is a healthy sign, and will eventually mean the crowding out of worthless and unnecessary material. It may be regarded as a distinct sign of progress that we no longer hear of those nostrums which were supposed to give such wonderful properties to the metal.

POINTS IN CUPOLA PRACTICE.

There is a demand for better apparatus for the foundry, higher efficiency in its use, and more uniform results. Sometimes the demands are too high and pass the point of real economy. Thus, if anyone can efficiently and continuously melt 17 pounds of iron with one pound of coke, he can beat me. If the jobbing foundry make it 11 to 1, I would call this excellent and safe work. A good foundry foreman need not be discouraged if he can show no better results than 9 to 1, as so much depends upon the coke, the class of work, and the peculiar knack he may have in handling his cupola to the best advantage. It may not surprise you that to make certain kinds of very small castings, requiring intense heat for successful pouring, 4 to 1 is used.

It seems to me that when too little coke is used, the bed becomes too thin, and even should the iron be sufficiently hot for pouring, there must be some danger of an absorption of oxygen from the blast, and consequently castings will result which are weaker than they otherwise would have been.

The number of types of cupolas is rapidly multiplying, that is, on paper. This is at least encouraging, as it shows that experimenting is going on, which will cause the well-established makers to add every possible improvement to their product, thus in turn benefiting the subsequent purchaser. It would seem to me that by keeping to a type of cupola which is economical in coke and at the same time simple in construction and handling, the best all around results will be obtained. Those who use "Simens-Martin" furnaces for their larger castings will have found a great improvement here also. The dream of the metallurgist has at least been fully realized in this instance, for we now work with a gas at all times, and reap the advantages this easily handled form of fuel bring with it. While we must naturally hope that the cessation of the natural gas supply is at some distance off yet, the coal gas producer has been nevertheless perfected to such an extent that it would be going backward indeed if even small plants were to take up direct coal firing again. With the regeneration of both air and producer gas, temperatures are obtained which an-

swer every purpose for steel or iron making. While we may never be able to make a gas as rich as the natural, with its 25,000 heat units to the pound, still undoubted success has attended the introduction of producers which combine in one operation all the advantages of the old Siemens, the water gas and the bench distillation types, even though the heat units per pound are but one-tenth those of the natural gas.

In looking over the field of apparatus for producing blast, we find that the fans are being brought down to more careful workmanship, so that there is less loss by friction, while the positive blowers, which I personally prefer, are now beginning to show improvements on mechanically correct lines, which also means less wear and tear and better results for the coal burned to run them.

THE QUESTION OF POWER.

The boiler question is at all times a serious one, as good boilers cost money, and the first cost is always watched so carefully. Modern practice is coming down to the water tube type as the most efficient, and for larger plants provision should be made for mechanical stoking and coal conveying.

Those who are fortunate enough still to use natural gas at advantageous terms for this purpose are not very numerous, but whatever selection is made among the numberless boilers in the market, care should be taken to have plenty of heating surface per rated horse-power, and a good evaporation per pound of combustible. This is to say, do not let any one sell you what would be rated a 100 h. p. boiler for your foundry, when you require 125. The first cost is often cut down by reducing the heating surface in the hope that forcing the boiler will make up for its poor steaming quality when running normal. The coal pile would soon show you what you were at.

It is interesting to find Corliss engines, running condensing, and often compounded, in places where their application, on account of the comparatively slow speed they run at, was heretofore considered inadvisable. Here, as well as in the conveying apparatus in the foundry, is the field for the trained mechanical

engineer. How many engines in the foundries here in this city are regularly indicated to see if they are in proper working condition? And as to boiler tests, are they not the exception rather than the rule? So also with feed water heating and purification. I remember not long ago a chief engineer of a fairly large power plant was sent about the country to learn something about the economy of running his engines condensing, and came back with his mind made up that there was nothing in it. For the credit of the plant I will add that he is no longer there, but this will show you that while the market will furnish the most economical appliances possible in the light of our present knowledge, yet this is not taken advantage of as it should be, especially in foundries, because the power plant is usually considered a secondary matter here.

LABOR-SAVING EQUIPMENT.

Where the castings are finished, such as in roll work and the heavier grade of machinery, we have in this city excellent examples of splendidly equipped plants, but the majority of the smaller foundries proper pay a disproportionate amount of attention to reducing the cost of molding per ton of output, compared with the numberless items not connected with the sand pile.

The last few years have witnessed a remarkable extension of the use of conveying apparatus in foundries. It seems like a regular evolution, step by step, until we now have as the most advanced, flexible and efficient piece of apparatus for this purpose, the electric traveling crane. This, with its three movements, capable of quick and accurate regulation, and only consuming power when running, gives an ideal method of carrying the molten metal to the molds, takes care of all the lifting and shaking out of flasks, and handles the finished work so nicely, that the cranes are a source of pleasure in addition to profit to those that possess them.

On the question of compressed aid in the foundry I will only say that what would be a waste in one place, becomes the best economy in another. Compressed air for some things is necessary no matter if it does entail a loss of the greater part of the original

power applied. Again, where there is a choice between it and electricity, the latter will usually be found the most efficient and least costly in repairs to the installation. Here, as well as for those cases arising in connection with the manufacture of specialties, it requires expert knowledge and sound judgment to choose the right thing for the right place.

In regard to the question of molding machines, these might be compared to the machines for turning out standard screws by the thousand. They reduce wonderfully the cost of the smaller castings, when made in quantity, and should aim at taking away the hard labor of the molder, but not that of his brains. It will, therefore, be found to pay to have a good molder in charge of the molding machines, with cheaper help to assist him; for sand must be tempered properly, cores set carefully, and attention paid to the smaller manipulations which make or unmake a perfect casting, and are the easier portion of the molder's work.

We have now four methods of cleaning castings to choose from. The old way with the steel brush, which will always remain for some purposes; the rattler, or the pickle tank for the smaller class of castings, and the sand blast for the very large ones. The sand blast is now sufficiently perfected so that we can use either steam or compressed air to project the sharp sand against the work and thus thoroughly clean it.

The rattler has the disadvantage of now and then breaking important work, so that the pickle tank is often the proper solution for this difficulty. We have the choice between sulphuric and hydrofluoric acids. The advantages of the latter are so obvious to those who have used both, that they prefer it. It dissolves the sand and not the iron. Its greater cost has been found to be no bar to its more and more extended use, especially for work which goes to the enamelling or nickel plating shops.

COST SHEETS.

Before we go into the question of the iron proper, there remains but to mention the importance of proper cost accounting in the foundry. In this country we have been accustomed to so comfortable a margin until recently, that there have been many leaks

in our costs, which we now see too late. In the old country this is quite different. For instance, in the most densely populated industrial districts in the world, namely, those of Belgium, cost sheets are prepared every fortnight, and thus the slightest deviation from the standard is detected. It is more than likely that our greater and cheaper output for the number of hands employed, when compared with Europe, is not due to economical working so much as it is to better methods, and the greater individual efforts each man must make to gain his livelihood. For the steady growth of a concern it is of vital importance that ready means should be had by the manager to know just what every department is doing at very short intervals.

MOST IMPORTANT OF ALL—THE IRON.

Taking up in conclusion the question of the iron itself, as used in the foundry, I will make the general statement that all iron is good for something, even if it be only floor plates or sash weights. This is no reason, however, why you should experiment with it at your cost, when you can satisfy yourselves of its possible value in other comparatively inexpensive ways.

The whole foundry industry was practically of a slow and cautious growth. It was a process of feeling one's way onward to the easiest and best methods of melting the then available iron to produce suitable castings. Science has stepped in afterwards, and taken the proven methods, discovered the principles underlying them, and thus was able to point out their limitations and suggest new lines of departure. It is therefore well to follow this slower process of development, even when applying the results of investigation, rather than jumping into too radical changes from tried and positive methods. Thus, in the gray iron foundry, if the closer pressure brought on by competition begins to push toward cheaper mixtures, it will be well to first thoroughly learn the why and wherefore of what you are now doing successfully, and then make the necessary changes slowly and with a thorough understanding of each new result obtained. For instance, in a line of work which requires very fluid iron for making light and

intricate gray castings, suppose certain brands of high phosphorus pig irons have been used for many years, and that this iron is expensive. Now you are offered cheaper irons, and desire to avail yourself of this chance, if possible. You will find it well to get first an analysis of what you use, and if practicable of what you have used, getting as wide a range of charge compositions as you can find, but always where good results have attended. Now you can begin to substitute first one item, then another; after this two at once with wider variations, but always with the sum total the same. This means silicon, manganese and phosphorus. Sulphur must be kept down at all times, while carbon seldom gives trouble in the foundry, being practically constant in the pig iron, and in form dependent on the other above named elements. It will be safe not to go too far with this use of widely varying material, for perfectly homogeneous baths of metal do not always result, it being well known that the forge irons melt easier than the foundry number ones and twos. I do not think it very wise to use nearly all scrap and bring up your charge properly by using ferro silicon, as is now recommended. The lack of uniformity in the iron will be apparent to all who may have tried it. It is quite possible that good results might be obtained this way, but there are other objections of which I will speak further on.

In nearly all classes of work the above process, as I have outlined it, is readily carried out; the only difficulty that will arise may be found in foundries which are compelled to buy large amounts of foreign scrap. Here they will be to some extent at sea, and only judicious sorting, careful sampling and numerous analyses continually checking the daily work and the stock on hand, will enable them to keep their product uniform. This is, in my opinion, quite possible, if, as I said before, the greatest care is taken in finding out what you get. Herein center most of the troubles of the foundryman.

We have then to deal with the following conditions in making up our charges: The pig iron, gates and runners from previous work, foreign scrap, and the coke,—taking for granted that the

regular conditions prevail in regard to handling the cupola. The question of pig iron was usually taken up on its fracture and capacity for carrying scrap. We now know that fracture depends upon the way the ore is handled in the blast furnace, in addition to the chemical composition of the resulting pig. The fracture alone is therefore no criterion. The capacity of rich foundry pig for carrying scrap depends practically altogether on its silicon contents. For the cheaper pig irons especial care must be taken to see that the composition is not only what has been called for, but also that it is uniform. Furthermore it is well to check the furnace analyses, experience having shown that this does no harm. One of the sins that can be laid to the door of the poorer grades of pig iron is the traces of slag they contain, and this feature, to which almost no attention is paid, may have an important bearing on the resulting castings.

The next item to be looked at is the daily collection of gates, runners, defective castings, and such material which may have been dumped out. This is practically scrap of which we know what it is, and can therefore readily make provision for its use. We must look at it for two things: First, that the charges in which it is to be used make up for the loss of silicon which has taken place in the previous melting; and, secondly, that only the quantity be used which experience has indicated as the best to obtain the proper grain in the castings, if I may so call it. We see therefore that in foundry practice much depends upon what may be termed the physical conditions of the iron, irrespective of its chemical contents. Thus, two irons may have the same chemical composition, have been cast at the same temperature, and yet have a different grain on fracture. Very much of this can be traced to the proportion of scrap used to pig.

In the charging of the cupola it is to be understood, of course, that in the mixing of the separate layers the latter are to be made as uniform as possible, unless, for other reasons, it is desirable to give the material richer in silicon and with a greater proportion of pig the bottom position; as, for instance, in making castings for electrical purposes, where the greatest magnetic permeability is desired and the first pour is specially arranged therefor.

It is furthermore desirable to pour the iron as cool as possible, consistent with proper feeding through the gates in the molds. This gives the slag which may not have separated in the cupola time to collect at the top and can thus be kept out of the castings. This point is not always fullyobserved, for probably one-quarter of the silicon and manganese in the charges is burned out in the melting, and this makes slag in the iron, which must be allowed to separate. If the iron is very hot it will readily come up, especially with the rich foundry irons which require higher temperatures to melt and are therefore accompanied by comparatively liquid slags. But the forge irons, which melt more easily have their slags nearer their melting points, and consequently are apt to be dirtier when cast. This point about slag is the special objection to using ferro silicon with great quantities of scrap. The scrap itself is probably none too clean, and the rich ferro silicon, melting off in drops, is naturally affected by the blast, and has burned out of it a greater proportion of its silicon than would have been the case with the silicon more evenly distributed throughout the charges. The result must tend toward lack of uniformity, and danger of dirty and therefore weak iron.

The matter of slag in castings is most readily studied in the making of steel ingots. Here the chilling of the surface of the ingot drives the more fusible slag inwards, and being lighter and aided by the formation of gas, it rises to the surface. The bearing of this on cast iron, even if in lesser degree, is obvious.

Those of you who are inclined to look more deeply into the philosophy of iron making, have probably found that we can learn more from failures than successes. Thus it is in this instance: If you get weak castings, you look about for the cause: if they were good, you would not bother about them. You will have the weak castings analyzed, and might find the trouble. Possibly there is too much manganese; this you can correct in the next day's run. But suppose you find the chemical condition normal. Then, to my mind, there may be two solutions: The presence of slag in the iron, either as lumps, or as a fine network which is not visible to the eye, disseminated between the crystals of iron;

or, it may be the presence of oxygen due to burning the iron. This is another of the questions connected with the foundry which has received little attention, and brings us to the consideration of the foreign scrap which we have to buy in the course of trade.

Suppose you were to use as part of your charge a lot of burned grate bars, would you expect strong iron as a result? Hardly! Here is a clear case of a material which requires the reducing action of the blast furnace, or else the basic open hearth bath for steel to make it useful again, and not the remelting in the cupola, which aggravates the evil instead of correcting it. Every pound of such material will be found to affect your work. And now what guarantee have you that the material you buy does not contain some dirty or burnt iron, or scrap made from it? The result is the weakening of the bond between the crystals of the iron, and hence in extreme cases, rotten castings.

With the coke used it becomes a question of sulphur. No matter if there have been good sound castings made with high sulphur in them, I believe it is a good thing to avoid, for a casting may be good in spite of the sulphur, and not because of it. Coke with high sulphur is therefore better let alone, and modern coke washing processes have given us the means of reducing this deleterious element to a minimum. Three per cent. is often found in cokes before washing, about one-half of which is removed in the operation.

In the foregoing remarks I have tried to take up the foundry question more from the somewhat neglected engineering standpoint rather than the strictly chemical one, and have avoided as much as possible a discussion of the painfully elaborate theories connected with the iron industry; for experience shows us that even with a perfect composition of our charges, carelessness in handling can ruin the work, whereas if the mixture is off, no amount of attention in its manipulation will correct it. I am inclined to think that as time passes on, everything will tend toward a more simple explanation of the occurrences which now puzzle us, and as the underlying truths gradually come to the surface, the field of view will broaden, and we will begin to see things more as

they really are. It may be years yet before even the more common phenomena are satisfactorily explained, and in the meantime it behooves us not to jump at conclusions too soon, but to take that which is good, and carefully look out for further enlightenment in this most interesting, and, when conditions permit, highly remunerative field.

Discussion followed the reading, and it was finally decided to refer the paper to a special committee of five practical founders who should make special study and be prepared to lead a more exhaustive discussion at the May meeting. President Taylor appointed as this committee Messrs. Fuller, Mobberly, Sleeth, Gilmore and Barker.

After transacting routine business, and extending a hearty vote of thanks to Dr. Moldenke, the association adjourned.

A REVIEW OF THE FOUNDRY LITERATURE OF THE MONTH.

AMERICAN MACHINEST.

In its issue of April 1st the American Machinist describes "A Novel Method of Testing Cast Iron for Hardness" in use at the works of the Warder, Bushnell & Glessner Company, at Springfield, Ohio.

"A Peculiar Method of Feeding Castings" is contributed to the American Machinist of April 15th by Geo. O. Vair. In it the author illustrates a method employed in western foundries for producing solid shoes and dies for stamp mills, where a projection is cast on the faces of these castings and pressed down with a rammer while in a semi-fluid condition to supply the shrinkage taking place in the interior of the casting.

In the following number of the same journal Charles H. Allmond, of Seattle, Wash., shows a practice recently followed by him of making large castings, such as are commonly made with dry sand cores, with green sand cores.

Mr. Allmond shows how the pattern was divided to permit of this being carried out. The casting which he illustrates being the head and part of the suction pipe for a 42-inch centrifugal pump.

THE IRON TRADE REVIEW.

O. April 15th illustrates a sand conveyer erected in the foundry of the Westinghouse Air Brake Co., Wilmerding, Pa., by Heyl & Patterson, of Pittsburg, who have secured a patent on this apparatus.

THE FOUNDRY.

A torsional testing machine employed by the Sandwich Enterprise Co., Sandwich, Ill., is illustrated in the April issue.

In "A Modern Foundry" a writer attempts to show that office expenditures are often out of all proportion to the output of the workshop, and traces to this source the failure of some well

equipped foundries to compete with others having inferior facilities.

"Making Castings Grow" describes some experiments made by A. E. Outerbridge, Jr., in which it is shown that a test bar by repeated heating was made to exceed in dimension the mold in which it was originally cast. It is also to be noted that these reheatings affect the strength of the iron, by causing molecular changes to take place.

MACHINERY.

W. H. Sargent illustrates a home-made testing machine which most foundries, who do not care to invest in an expensive machine, are capable of duplicating. The author shows how an ordinary platform scale may be converted into a testing machine for obtaining the transverse strength of cast iron.

THE TRADESMAN.

An illustrated description of the Chattanooga (Tenn.) Foundry and Pipe Works is printed in the issue of April 15th.

IRON MOLDERS' JOURNAL.

Thos. A. Haigh illustrates the molding of a branch pipe on what is commonly called the "emergency" plan.

In referring to the annual convention of the American Foundrymen's Association, and the two principal questions which will be brought before that body, viz., the apprenticeship question and the proposed Defense Association, the same journal says editorially:

We stand squarely on the principle of the amicable arbitration of disputes as opposed to the strike, and any equitable system to this end will receive our hearty support.

The same might be said on the apprenticeship system, for which all recognize a crying necessity if the standard of skill of our molders is to be maintained and improved. The cry is common among foundrymen that the molder of to-day is the inferior in point of skill of the molder of the past, and that he is con-

stantly deteriorating. That this is really the case is open to serious question, but one thing is certain, the treatment accorded by foundrymen to their apprentices, in too many cases, will not tend to make a better mechanic of the future, so that the inauguration of a system whereby more attention is assured to their instruction would be welcomed by all who have the interest of the trade at heart.

We would respectfully suggest discussion upon an equally if not more important subject by the association—the eight-hour work-day. That is the question of all questions to the working men of to-day, and it is one upon which we should have an expression of opinion from an employers' association. We have been advised at one time and another that some of the foundrymen included in the above association are favorable to the eight-hour system, and we look to them to bring the matter forward and give it a hearing.

THE BOILER MAKER.

A contributor to this journal signing himself M. E., has the following to say about the use of cast iron in boiler construction:

Very frequently articles appear in engineering journals about the unreliability of cast iron when used for pressure parts of steam boilers, and the same objection to this material for such use is also quite frequently met with from consulting engineers, who, in drawing up specifications for steam plants, discriminate between wrought and cast iron, at the expense of the latter.

When we begin to analyze the reasons for these objections against this much abused material, cast iron, it becomes apparent to us that they are mainly based upon the less satisfactory results of the cast iron boiler parts, as they were designed and used years ago, and upon the prejudice handed down from that time.

The art of designing such castings of the proper shape, which is probably the most important point in their construction, was not so fully understood twenty-five years ago as it is to-day, nor was such care taken to get the best possible mixture of iron in them, or to keep this mixture as nearly alike as possible for all castings of this kind.

These points of construction have received the closest attention by builders of steam boilers of the cast iron sectional type, and have undergone such improvements as to make them as safe as any other parts of the boiler. Before leaving the factory such cast iron sections are always subjected to the most rigid inspection, and are finally tested hydraulically to a very much greater pressure than the boiler will ever carry.

Now, it is claimed that, while the casting in question may show up strong enough under a test, yet it is liable to possess hidden flaws or defects in shape of blow-holes, etc., and these may make themselves known suddenly at some unexpected moment. The soundness of this argument has always appeared rather doubtful to the writer, who has made it a point to watch this subject for years, and who in this time has seen or heard of but very few cases where such defects have caused any calamity; in fact, there are fewer minor accidents connected with the use of cast iron sectional boilers of standard designs than with most any other kind of water-tube boiler in the market; only minor accidents are referred to; large ones occur but very rarely with any of the boilers referred to.

To prove this statement it will only be necessary to call attention to the records of some of the most prominent sectional water-tube boilers in the market at the present time, and who employ this material in their construction, viz., the Babcock & Wilcox, the National, the Campbell & Hill, the Abenroth & Root, the Standard, etc., etc.

The sections of any of these boilers have frequently been tested under hydraulic pressure to pressures between 1,200 and 1,500 pounds per square inch, without bursting, and in all cases they are tested to pressures between 300 and 400 pounds per square inch, before being allowed to leave the shops, so that if any hidden defects exist, they certainly have a most excellent chance to show themselves under such severe tests.

It is not only as sections of sectional boilers that cast iron is being crowded out by unjust prejudice against a splendid material, but even its old time-honored positions as man-hole and hand-hole covers and guards are being contested.

The above remarks are made especially for boilers working under ordinary pressures up to 125 pounds; for such pressures there are no good reasons for excluding cast iron from the specifications for steam boilers, except it should be for some particular boiler concern's special benefit.